Case study of sustainable sanitation projects

Urban urine diversion dehydration toilets and reuse Ouagadougou, Burkina Faso - draft

Fig. 1: Project location

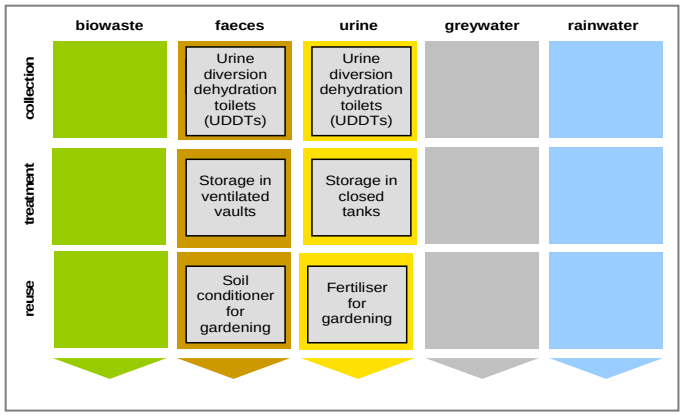

Fig. 2: Applied sanitation components in this project

1 General data

Type of project:
Large urban pilot project

Project period:
EU project phase: June 2006 – December 2009 (the municipality is financially supporting the project from January 2010 onwards)
Start of planning: June 2006
Start of construction: December 2007
End of construction: Mai 2009
Start of operation of toilets and transport system: January 2008

Project scale:
- UDDTs built for 922 households and at 11 public places (such as prisons, community centres) – approx. 6,500 people (if 6.5 people per household toilet are assumed) and 500 users at the public places
- 800 gardeners/small farmers trained
- Total investment of 3-year project: EUR 1.497,120

Address of project location:
Districts within the city of Ouagadougou, Burkina Faso: Districts of Boulmiougou (sectors 17 and 19), of Nongremasson (sector 27), and of Bogodogo (sector 30),

Planning institution:
- Centre régional pour l'Approvisionnement en Eau Potable et l'Assainissement à faible coût (CREPA, Burkina Faso)
- German Technical Cooperation (GTZ, Germany)
- Office National de l'Eau et de l'Assainissement (ONEA, Burkina Faso)

Executing institution:
CREPA: a local NGO in Burkina Faso

Supporting agencies:
- European Union: EUR 1.11 million (under ACP-EU Water Facility Scheme)
- CREPA, Burkina Faso: EUR 207,120
- GTZ-Burkina Faso (Water Program, PEA (in French)): EUR 180,000 and GTZ headquarters (Ecosan Program) - on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ)

2 Objective and motivation of the project

The aim of the project was to achieve the following goals within a period of three years:

1. Facilitate access to sustainable, safe and affordable sanitation systems[1] for the residents of the disadvantaged and rapidly growing sectors of Ouagadougou, Burkina Faso.
2. Support 1,000 households in obtaining appropriate and affordable closed-loop sanitation.
3. Demonstrate novel excreta management systems that protect human health, contribute to food security, and enhance the protection of natural resources.
4. Promote small and medium sized businesses in the sanitation market.

The following five specific objectives were set out:
- Build 1,000 urine diversion dehydration toilets (UDDTs).
- Support the establishment of two "supply chains" (by establishing association) for the collection, transport and distribution of the raw and the treated excreta.
- Train 1,000 gardeners to use these products (ecosan fertilisers).
- Support 20 SMEs (small to medium size enterprises) to be involved in construction of public toilets as well as system operation.

Fig. 3: Outside and inside views of a single vault UDDT constructed at town halls in Ouagadougou (with urine diversion seat) (source: CREPA, 2008).

[1] Here, the term "sanitation systems" only refers to excreta management (and hand washing); other components of sanitation (greywater, solid waste, drainage) were not part of this project.

- Train 100 artisans (masons etc.) to provide the necessary infrastructure, in particular the construction of the toilets.

3 Location and conditions

The capital city of the landlocked West African nation Burkina Faso, Ouagadougou, and its peri-urban sectors are the project location. The city is administratively divided into five districts: Baskuy, Bogodogo, Boulmiougou, Nongremasson, and Signoghin. Each of these districts is administered by a council led by an elected mayor.

Until recently, sanitation had a rather low priority for development in Burkina Faso. In Ouagadougou, only 19% (according the baseline study performed within the project) of the population of a total of 1.4 million people had access to improved sanitation (according to MDG definition) in 2006 (such as septic tanks, VIP latrines, pour flush latrines, sewerage, etc.). With an annual population growth rate of around 5% it is difficult to maintain pace with growth – particularly in low income peri-urban areas of the city.

The implementation of the project addresses **four sectors** (of a total of 30 sectors) within the districts of Boulmiougou (sector 17 and 19), Nongremasson (sector 27), and Bogodogo (sector 30).

In order to achieve the project objectives, the project partners GTZ, CREPA and ONEA identified three major fields of activity.

1. Firstly, ecological sanitation (ecosan) systems were developed with the users of these systems, responding to their needs and the local context.
2. Secondly, lobbying and advocacy work were carried out at municipal and governmental level in order to create an enabling environment for ecosan and ensure its inclusion in legislation and future strategic plans. This second field of activity also served to create the conditions for the third field.
3. To support and promote the involvement of the local private sector in furnishing the infrastructure and logistical services required by the system.

What about the identification of the location as a first step? Who could get a UDDT? Everybody or only selected households?

In Burkina Faso, the under-five child mortality rate is currently **169 children per 1000**, which is very high but at least there is currently a downward trend towards fewer child deaths.[2]

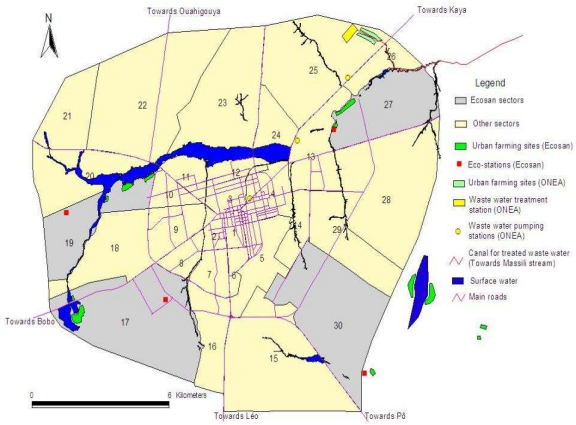

Fig. 4: UDDTs are located in four sectors (here in grey) out of the 30 sectors in Ouagadougou city map (total diameter of the city is approx. 18 km) (source: CREPA, 2008).

4 Project history

In 2005, the German Technical Cooperation (GTZ), the West African Centre for Low Cost Water Supply and Sanitation (CREPA), and the National Office for Water Supply and Sanitation (ONEA) developed a project proposal for a 3-year project entitled "Ecological sanitation in peripheral neighbourhoods of Ouagadougou" (in French: "Projet d'assainissement écologique dans les quartiers périphériques de Ouagadougou"). The project, which was approved in early 2006 was mainly financed by the ACP-EU[3] Water Facility (74% out of the total of EUR 1.48 million), and co-financed by GTZ-Burkina Faso (12%), and CREPA (14%). The contribution of ONEA was the mobilisation of skilled staff.

The project (commonly known by the French name ECOSAN_UE) began in June 2006 and was initially planned to last until June 2009. The project was however carried on until December 2009, since a cost-neutral extension was granted.

In the first year, there was an intensive dialogue period with various stakeholders from municipal authorities, households and the local private sector, in order to assess needs and establish the framework within which the system was developed. The baseline study as well as a strategic ecosan plan including technical, logistical and organisational proposals were made and validated with the various stakeholders, before any work began to put the system in place.

Masons were trained to build three different urine diversion dehydration toilet (UDDT) types.

Gardeners and farmers were consulted and trained on the application of treated urine on their crops in the beginning of the project. When the project started to be operational, the use of treated faeces got in vogue among farmers since they thought it would be easier to use and apply it compared to urine. Households were consulted on their preferences, and community-based organisations were supported in setting up collection and transport businesses (associations).

[2] The under-five mortality rate is the probability (expressed as a rate per 1,000 live births) of a child born in a specified year dying before reaching the age of five if subject to current age-specific mortality rates (http://www.childinfo.org/mortality.html and http://www.childmortality.org/).

[3] ACP-EU stands for Africa, the Caribbean, the Pacific and the European Union. This project was funded under the first call for proposals (category C for "civil society initiatives") which took place in 2005 (http://ec.europa.eu/europeaid/where/acp/regional-cooperation/water/index_en.htm)

The construction activities started in December 2007 and one year later, by December 2008, about 500 private UDDTs and 11 UDDTs at public places (in and around communal structures to raise awareness) had been built. Also, gardeners had harvested their second season of crops treated with ecosan fertilizer (sanitised urine and faeces).

The public UDDTs were installed at the following places: three at the central prison of Ouagadougou (MACO), one at the park Bangrweogo, two at each Town Hall (4 in total) and one at the zoo.

The prisoners at the MACO prison are in charge of the management of the whole system: O&M of the toilets, treatment of the collected urine and faeces, and agricultural reuse of the ecosan by-products in their own fields in the prison.
Many households were indeed willing to have a UDDT installed at their house, but they could not afford one despite the existing subsidies (see chapter 9 for details). Through increasing the subsidies, it was possible to build more than 400 double vault UDDTs within 6 months. However, overall numbers on how many households wanted a UDDT and how many got one (by help of subsidies) in the end are not available.

By June 2009, 922 homes were using UDDTs (867 double vault UDDTs, 18 single vault UDDTs and 37 box-type UDDTs). So far, 107 artisans have been trained to build the three different toilet types and some 800 gardeners and small-scale farmers on the application of treated faeces and urine on their crops.

The main challenge at present is to ensure further development of the project's main achievements (such as system management in place) and activities through local authorities. The municipality of Ouagadougou has now allocated EUR 10,670 (CFA 7 million) of its budget in 2010 to keep the ecosan system functioning (equals about EUR 10.64 per UDDT if it is assumed that 6,500 users benefit from the UDDTs).

The average household size is 6.5 people. The number of persons using a UDDT is varying from 4 to 25 persons depending of households. In polygamous households, the head of household who is occupying the main house, as well as his wives and children living in additional houses on the same compound. They all share the UDDT and are considered as one household.

5 Technologies applied

The project team gave households the choice between double vault and single vault UDDTs. However, after a first assessment, it was decided to stop building single vault UDDTs, because of difficulties related to their management (handling of faeces). Double vault UDDTs made of banco (adobe) bricks were also tested but soon removed as a technical option due to problems during the rainy period (collapse).

Building the vault with local material was an attempt to reduce costs, however this failed since the structures were not strong enough (despite vaults being made of a double layer of adobe bricks).

The physical infrastructure of the ecosan system consists of:

1. UDDTs at household level and at public places in four sectors of Ouagadougou.
2. Four treatment sites (called eco-stations) for urine and faeces in the same four sectors (each run by a separate association) (see Fig. 8).
3. Collection, transport and delivery of urine, dried faeces, sanitised urine and of sanitised dried faeces.
4. Peri-urban gardens/fields were sanitised urine and faeces are used.

Fig. 5: The ecosan system as implemented within the project (source: CREPA, 2008).

User interface and collection of urine and faeces

The user interface is a squatting pan with a small hole for urine collection (which flows into a yellow 20 L jerrycan for storage) and a hole for defecation. There is also a designated area for anal washing in the toilet cabin. The anal wash-water is simply infiltrated in a gravel bed (per toilet use, about 0.5 L of anal wash-water is used every time).

Three types of urine diversion dehydration toilets (UDDTs) were initially used for the collection of faeces and urine: double-vault toilets, single-vault toilets and "box toilets" (for informal areas)[4]. One cup of ash is used as added material to cover the faeces after each defecation event.

Once the first of two vaults of the UDDT is full, it should be closed for a while (approximately 6-12 months), while the second vault is used. The faeces in the first vault remain in the vault for at least six months for sanitisation by drying/storage. The vaults are then emptied by the collection service workers and brought to an eco-station for a further drying/storage period of two months and for final packaging (see additional photos (link to flickr in section 13).

For cultural reasons and reasons of convenience when emptying the UDDTS, most of them are built outside. There are however also others in houses, requiring much more delicate maintenance (section13).

[4]There are areas where houses are spontaneously and illegally installed. Thus, there are no appropriate facilities/infrastructures.

Fig. 6: UDDT inside a house (inside, backside view and waterless) (source: A. Fall, 2010).

A low cost variant of the single vault toilet has been the so-called "box toilet", which is a urine diversion box made out of ferrocement (reinforced concrete) and a superstructure made up of local material. In some cases, the entrance was build with an angle and thus no door was needed.

Alongside the public UDDTs, urinals (made from local material) were also installed.

For the transport to the eco-stations, urine is collected in 20 L yellow jerrycans, and faeces are transported in plastic bags.

Fig. 7: Outside and inside views of a double vault UDDT with urine diversion squatting pans and anal wash area (dark circle in the middle). Urine jerrycans are stored under the stairs (left picture) (source: CREPA, 2008).

Treatment of urine and faeces

A central point of the urban ecosan system is the treatment site, also called eco-station, which connects the households (producers of ecosan fertilisers) with the gardeners/small-scale farmers (users of ecosan fertiliser). Two of the five eco-stations are built near the sites of market-gardening[5], another at the central prison and two near the collection points of municipal waste transported from these points to the landfills outside the town.

In total, five eco-stations were built. The eco-stations are equipped with the sanitising equipment required (plastic tanks for urine and storage pits for faeces) and accompanying infrastructure such as a hangar for the working material, space for nutrition and maintenance of the donkeys which pull trolleys of urine jerrycans and a storage room for the finished fertiliser products.

The number of plastic urine tanks with 1 m³ at each eco-station varies from 6 (in small sectors such as 19 and 27) to 12 (large sectors like 17 and 30).

[5] The products of the gardening (vegetables, fruits, etc.) are also sold on-site.

For sanitisation reasons, urine is transferred to the eco-stations and **stored for one month** in the closed 1 m^3 plastic tanks. In contrast, faeces from double vault UDDTs are stored and kept dry in chambers (total volume: 6 m^3) **for two months**[6]. Faeces from single vault or box UDDTs are regularly collected and stored in separate 6 m^3 chambers for a period of 6 to 8 months. No composting takes place.

Data to check for cross contamination of urine with faeces has not been collected.

Fig. 8: Eco-station with four 1 m^3 plastic tanks for urine sanitisation (by storage over a period of one month) in sector 27 (source: A. Fall, 2009).

6 Design information

Double vault UDDTs were designed for households with 6 to 7 members and the storage time for the faeces is about 6 to 8 months. However, two vaults of this size can normally cater even up to 15 persons. The vaults have sizes of three blocks (20 cm each) plus mortar between blocks. So, they have a total height of 65 cm, a width of 145 cm a length of 130 cm and a volume of 1,220 L.

To save costs, the urine diversion squatting pans (for double and single vault UDDTs) and pedestals (of box UDDTs) are made of concrete which is easy to use and to maintain. Both pans and pedestals were purchased through local manufacturers who were trained by CREPA within the project.

The single vault UDDTs and the box toilets have a plastic bin with a volume of 50 L. Recycled or plastic bags ("rice bags") are placed in the container to collect faeces. Once the bags are full, they are stored in former/empty oil barrels, which are painted black, next to the toilet or in another safe place. Full bags are collected twice a month and transported to the eco-stations for further storage of six months and packaging.

Each household was given at least three yellow 20-L jerrycans for urine collection. Full jerrycans (often two or three depending of the size of household) are collected by the eco-

[6] The WHO Guidelines for the safe use of excreta, greywater and wastewater in agriculture (from 2006) should be consulted for further details on the required storage times: http://www.who.int/water_sanitation_health/wastewater/gsuww/en/index.html.

station workers once a month and transported to the treatment site[7].

Every full 20-L jerrycan collected is replaced by an empty one. The storage space for the urine storage containers is under the stairs of the toilet and is thus easily accessible for collectors and household members (as UDDTs are built separately from the houses). The urine pipes have a sufficient slope to completely drain the collected urine into the jerrycans. Thus, urine odour is kept at a minimum.

All UDDTs were built entirely above ground to facilitate the air circulation in the vaults/buckets, thus accelerating the drying process. The toilet buildings have a small staircase (2 to 3 steps). For physically impaired people, the staircases are installed with a ramp or an iron bar to facilitate access to the toilet.

The toilet superstructure is made of different materials. The wall material is chosen by the household and depends on availability and affordability. Mud or cement bricks have been used for the walls. Galvanised steel sheets were used for the roof and standardised metal doors were provided by the project instead of the use of straw mats, which are cheap but whose degradation is quick. A metal door seems to be quite sustainable but requires a technical implementation and good paint layer to be weather resistant.

Ventilation is provided through ventilation pipes at the back of the toilet building. The vent pipe is made of PVC and has a diameter of 110 mm. Only one vent pipe serves two vaults and is at least 0.3 m longer and thus higher than the roof. The openings are covered with fly screens to prevent insect access.

To facilitate the collection in the households, the sectors are divided into smaller areas. The biggest sectors (17 and 30) are divided in 12 areas and the small ones (19 and 27) are divided in 6 areas. Each team of collectors has to visit all latrines in 6 areas within 2 weeks. Unfortunately, there are long distance between the UDDTs and also between eco-stations and UDDTs. Hence the collectors may have to cover distances of up to 12 km (the daily work time is estimated to 5-6 hours).

In total, there are four associations operating with approx. 28 people, 10 donkeys and 10 donkey carts. In the small sectors (19 and 27), each association works with 2 donkeys, 2 donkey carts and 6 workers, while the numbers in the biggest sectors (17 and 30) are 3, 3 and 8 respectively. At the prison, the prisoners are involved in the functioning and management of the eco-station.

7 Type and level of reuse

The project has benefited from the extensive experience of CREPA in the field of safe reuse of ecosan products (sanitised urine and dried faeces) in Burkina Faso and other countries in West Africa.

At the beginning of the project, the technical team and facilitators informed the households and farmers about the benefits of using ecosan products for crop production. The information campaigns during project implementation included training sessions on the safe use of dried faeces and urine.

To increase acceptance among the users (gardeners, farmers and consumers), it was decided to label the ecosan products as follows: Sanitised urine was sold in green 20-L cans labelled "**birg-koom**" in the local language (which means liquid fertiliser), while sanitised dried faeces are sold in bags labelled "**birg-koenga**" (meaning solid fertiliser).

One important aspect of the project was to ensure the quality and also the safety of the ecosan products sold to the farmers. The gardeners and small-scale farmers were specifically trained to use the treated urine and faeces on different vegetables (such as tomato, cabbage, cucumber, zucchini, carrot, salad, aubergine, strawberry).

Moreover, samples of sanitised urine and dried faeces have been taken and analysed by the National Water Laboratory (Laboratoire National des Eaux) for N, P and K values, and for pathogens such as E. coli. First results have shown that sanitised urine is safe (without pathogens) and has no negative impact on the environment and the health when used as fertiliser (see Makaya (2009) in Section 13).

However, when considering the meagre budget allocated to the project and the fact that municipalities are managing the project now, products are not really analysed. Probably it will be more an appropriate subject for MSc and PhD students to work on those topics. For instance what are the results for the faeces?

Given the fact that faeces take more time to be collected and then sanitised, the focus has been placed on urine which is the bulk of the excreta. Urine is collected and available within a day, and it had already been reused by farmers during the EU project time. However, urine reuse is still something very strange for the people and some authorities, thus it will be important to show that it is natural and harmless.

Analysis of the crop fertilised by sanitised urine and dried faeces is conducted within the EU-financed project ecosan_UE2 which is still ongoing.

Fig. 9: The workers of the associations deliver ecosan products (sanitised urine fertiliser in green jerrycans) by donkey carts to gardeners and sometimes show them how to use the product (source: CREPA, 2009).

[7] Note: A household of 6.5 people and urine production of 0.5 L/cap/d could produce about 48 L of urine in a two week period (the three jerrycans give a volume of only 60 L). But, not all "expected" urine is collected at home; since most of household members urinate by using toilets at their work places / schools or are on their fields during the day.

Fig. 10: A group of gardeners in Ouagadougou who use stored urine, called birg-koom (source: A. Fall, 2009).

Having witnessed the crop yields using sanitised urine and dried faeces, gardeners and small-scale farmers are now willing to **pay for these novel fertilisers** (for prices see Section 9).

Birg-koom (sanitised urine) is promoted as a fast acting, nitrogen rich fertiliser to be used during the growth phase of the plant, whereas birg-koenga (sanitised faeces) is promoted as a soil conditioner (base fertiliser).

Due to a low filling rate of the UDDT vaults and a longer storage time for treatment, not much faeces have been collected und used as fertilisers yet. Hence, the reuse activities have focused more on the application of sanitised urine.

8 Further project components

Throughout the project, a strategy of close cooperation with communal authorities, community-based organisations in peri-urban areas, and the local private sector was adopted. This strategy brought about positive results and a high degree of engagement from all actors involved. The project has intensively focused on the involvement of these actors, in order to increase their capacities to engage in a programme of sustainable sanitation systems aiming at ensuring that activities will be integrated into ongoing work when the initial project ended.

To ensure that the sanitation system meets the needs and expectations of all actors, the project has adopted a participatory and multidisciplinary approach with an appropriate legislative and regulatory framework (see document of capitalisation in section 13). The users (and farmers) are the key stakeholders in system design and operation.

The project put a strong focus on active local stakeholder participation during the planning and implementation stages. It started with information campaigns on health, hygiene and sanitation, which included discussions of the existing situation.

The municipal representatives as well as representatives from different community groups were involved in the design of the baseline study and the strategic ecosan plan. What do you mean by baseline study and how did the involvement of locals look like? Moreover, they were accompanying the project in planning, implementation and evaluation through the guiding committees (in French: comités directeurs) that were formed in each sector. The households were invited for validation of the baseline study results and the strategic plan.

Training sessions at all levels, particularly on maintaining the UDDTs and on practicing a safe reuse also constituted further important aspects of the project.

Monitoring activities throughout the entire project phase were an integral part of the project cycle. This allowed improving the design, mitigating construction errors, ensuring that the households maintained their new toilet facilities properly, and to encouraging safe reuse practices.

Further project components are:

- Research on agricultural reuse, health and socioeconomic aspects of ecosan, as part of the large research program on ecosan being carried out by CREPA and financed by SIDA.
- Capacity building on ecosan for the government, civil society and private sector.
- Policy advocacy for decision makers such as assistance in drafting an executive order for the establishment of a technical working group on sustainable sanitation at the national level, including all national key stakeholders in the following sectors: water and sanitation, environment, health, agriculture, research and education, etc. The new Direction Générale de l'Assainissement, des Eaux Usées et des Excréta (DGAEUE) was designated to be the national ecosan coordinator.
- Promotion of ecosan through diverse media (television, radio, internet, newsletter, etc.) and at national and international events (lecture, trainings courses, etc.).

9 Costs and economics

The capital costs for four types of UDDTs are shown in Table 1 below, depending of the quality of material use for the construction. Attempts were made to reduce the costs through a modified design. However, especially for the single vault UDDT, costs could only be reduced by about 16% by choosing cheaper materials for the superstructure.

Table 1: Prices of the different UDDT types, and contribution of the ECOSAN_UE project and beneficiaries (includes all materials and labour).

Toilet types	Value in EUR		
	Subsidy from the project	Contribution of the beneficiary	Total cost of the toilet
1.1. Double vault with superstructure (in cement)	168 (61%)	108	276
1.2. Double vault with superstructure (in mud)	168 (74%)	60	228
2. Single vault in cement	158 (64%)	90	248
3. Box with mud superstructure	125 (84%)	24	149

A cost breakdown for one UDDT with material and labour costs is not available. For a comparison of all the costs with the costs of the ONEA latrines, particularly the VIPs (see section 13: document on study for financial and economic analysis – What is its title?)

The households were involved in the construction process of the toilets by providing building material and assistance for the construction workers.

The construction costs were so high that many low-income households could not build UDDTs without external funding. Despite the subsidy given to each household, only 500 UDDTs were installed up to December 2008, six months before the project was due to end.

To boost the number of UDDTs built, the project team decided in December 2008 to give an additional subsidy of about EUR 38 per household (through a total contribution of EUR 15,000 by the Regional Ecosan Programme of CREPA). With this subsidy additional 400 UDDTs were built.

This subsidy was in form of material needed for the construction of the UDDTs, and included the salary of the mason. Therefore, for the last 400 UDDTs constructed between December 2008 and June 2009, the households contributed around 10 % (for toilets with walls in mud) or 25 % (for toilets with walls in cement) of the construction costs through material for the super-structure and unskilled labour.

Regarding the management of the system chain, about 12 SMEs/CBOs (small to medium enterprises / community-based organisations) were identified, trained and involved in the project implementation. For the operation (collection, transport, treatment, management and delivery, etc.), eight out of twelve were selected: this means 2 associations per sector. In order to decrease the management cost, the two have been asked to form one association in each sector (one SME per eco-station; these are called “associations”). The monthly income for each association is made up of a fixed sum (being in essence a subsidy component financed from the EU project) and a variable sum. The fixed sum was EUR 300 for each association in the sectors 17 and 30 (which are larger in terms of area), and EUR 230 for each association in the sectors 19 and 27. It is planned that the Municipality of Ouagadougou takes over this fixed amount after the EU project ends.

The variable income for the associations includes:

- The monthly collection of about EUR 0.5 (300 FCFA) per UDDT (the amount depends of the number households that are able to pay[8]) – in theory this should amount to EUR 461 per month as there are 922 households with a UDDT,
- The income from selling the ecosan fertilisers i.e. sanitised urine and dried faeces to gardeners and small farmers. The birg-koom fertiliser (sanitised urine) is sold for **EUR 0.15 for a 20-L jerrycan** (equals 100 F CFA) or **EUR 7.5 per m^3**. The price for birg-koenga fertiliser (sanitised faeces) would be EUR 3.86 for the 50 kg-bag (2500 F CFA)[9] although less of this fertiliser has been sold so far.

The fixed price for ecosan fertilisers is the result of a workshop in March 2009. This workshop brought together all actors involved in the management and use of ecosan fertilisers, such as gardeners of old and new sites[10], vendors and developers of chemical fertilisers, associations responsible for the delivery of ecosan fertilisers, farmers, private individuals and municipal representatives.

The monthly expenditure of the association consists primarily of salaries, food for the donkeys, maintenance work at the eco-stations, as well as transport and communication (calling) expenses for the responsible. The exact monthly expenditure varies from EUR 200 to 220.

In theory, it would be possible for the associations to cover the operational costs of the ecosan system with these income streams. In practice, however, the demand for ecosan fertilisers is not always sufficient and unfortunately many households (80%) do not accept to pay the collection fee.

The urine sale would therefore generate EUR 8,640 per year for the 5,993 people covered in the project (or EUR 1.45 per person per year), not counting the UDDTs at public places (assuming collection of 0.5 L urine per person per day). If this approach was up scaled to cover the entire population of 1.4 million people, it would mean that the urine has a value of EUR 2 million per year for the city of Ouagadougou.

10 Operation and maintenance

At the household level, operation and maintenance include keeping the toilets clean, covering the faeces after defecation with ash, and monitoring the urine and faeces levels in the collection jerrycans and vaults. These tasks are mostly done by the women and girls of the household (the covering of faeces with ash is done by each user himself).

A common social practise in Ouagadougou is that people use water for anal washing however some of them may use toilet paper instead.

For UDDTs at public places or institutions, the facilities are maintained by a staff member. In the Ouagadougou prison, prisoners are in charge of this work.

Short monitoring visits to observe the proper use and operation of UDDTs were usually conducted two weeks after the users began to use the UDDTs. A more comprehensive monitoring was conducted after several months of operation. This included technical aspects (maintenance, functionality) as well as the general perception of the users, their satisfaction with the ecosan system and reuse practices. Does this continue now that the project is over? Does City hall take care of that?

The results of these monitoring activities showed that the vast majority of users were motivated and able to operate and maintain their UDDTs properly. However, in some cases additional instructions were necessary.

At the treatment sites (eco-stations), the faeces are left in drying chambers depending on the arrival date on site or the commissioning drying date, followed by sorting, made to remove non-degradable particle from the product in the chambers from time to time to enhance the drying process.

The use of ash as an additional material favours the climate conditions for better dehydration. Faeces that have spent already six months in the pit (after it was full) are very often already well dried. This second period of hygienisation is made to ensure “security” for the users.

[8] On average about 50% of the household do not pay the monthly collection fee.

[9] If 922 households with 6.5 members deliver half their daily urine production (say half of 1L/cap/d), this would be about 96 m^3 urine collected in the system per month. Hence, this would result in an income of EUR 720 per month for the sold urine fertiliser.

[10] For a larger promotion of the ecosan fertiliser, new gardening areas were identified, in addition to the four first (old) ones. Gardener/small farmer from these new areas were also trained and involved in the project

All other tasks in the treatment sites (such as cleaning, emptying yellow urine jerrycans and putting the content into the large plastic tanks, emptying the large plastic tanks into the green urine jerrycans, taking care of material and donkeys, etc.) are done by the staff of the association in charge of the site.

In the institutional arrangement, the ECOSAN_UE project sponsors the equipment of the beneficiary (household, farmers and associations). It also built and equipped eco-stations in each sector of the project. It signed management contract with the local associations and followed their activities. But since last year, the project is in charge of the municipality. The municipality have the needed funds for managing of the eco-stations and the replacement of equipments and took over.

These associations were trained to fulfil their duties which are:

- Collect the filled jerrycans and the sacks of faeces that come from single vault UDDTs.
- Replace the number of full jerrycans collected by empty ones at the households.
- Empty the filled vaults of double vault UDDTs.
- Transport the excreta to the eco-stations.
- Supervise excreta hygienisation at the eco-stations.
- Ensure handling of excreta in the eco-stations and delivering of the end products to the farmers if needed.
- Administer the excreta collection fees from the household and the money for sale of ecosan fertiliser

11 Practical experience and lessons learnt

All project target groups say that the UDDTs are very useful (household members who have changed from traditional pit latrines and gardeners who now have an affordable natural fertiliser).

But most of the UDDT users said that the anal washing area was inconvenient to use, since firstly there is too little space available, secondly it is very shallow and thirdly it is located too close to the wall.

The cleaning of the toilet bowl or squatting pan is a big concern especially when there are many users who do not know how to use it properly (such as when some of the faeces remain on the sides of the bowl after defecation).

There have also been problems with blocked urine pipes when ash is added to the urine part of the squatting pan by mistake.

At public places, apart from the prison, the project has faced great difficulties in the use and maintenance of the UDDTs. This is mainly due to the fact that the people responsible of these places have never created the required condition which was agreed upon before construction (ensure compliance of guideline of UDDTs use).

At the level of the different town halls, the gardeners were trained to take care of the toilet and use the end product in the gardens. In the park (Parc Bangrweogo), it was therefore expected that a private service takes money from the toilet users, and ensures the O&M activities. But none of these stakeholders fulfilled their commitment despite the multiple calls from the project team and the effort to sensitise users with pictures on how to use the toilet. As a solution, the toilets at the zoo and the park were simply closed. People in charge of the town hall decided to limit the access to the UDDTs for their employees only by using keys. As result, these toilets are not used any more. Hence, a successful use of public toilets is strongly linked to an appropriate cleaning and management system. How much did the public UDDTs cost per block?

Further problems and challenges with the ecosan system include:

- Difficulties to reach the households due to the bad quality of roads in the sectors especially during the rainy season.
- Misuse of latrines (lack of ash, insertion of water in the faeces vault, etc) particularly in the rented properties (and particularly for single vault UDDTs) most often when many families live in the same compound and sharing a UDDT; generally they don't take good care of the toilet.
- Collection of faeces sacks from single vault UDDTs in the donkey carts without intermediate storage at household (household members do not want to handle the faeces sacks even if they are filled and rather wait for the collectors to remove the sack and place it in the cart directly).
- Leakage of plastic 1 m^3 urine tanks ("polytanks"), during the storage: between the tank and the emptying pipe at the base. (see pictures on flickr)
- Low storage capacities of eco-stations, especially because demand for urine by farmer is still low. Thus, urine remains a long time at the eco-station after being sanitised.
- Low level of demand of ecosan fertiliser by the farmers in certain sectors and high level in others: the long distance between the eco-stations to balance the demands is a challenge.
- Difficulties in the delivering of products to remote areas due to a lack of transportation (demand in remote areas and surrounding village is great, but due to difficulties in transportation, products are very expensive to the farmer as end consumer).
- Irregular payment of workers leads sometimes to the non-collection of products from households; which oblige sometimes households to empty the filled jerrycans in nature because of lack of empty jerrycans to use.
- Impossible to cover the operating costs of the ecosan system without external support (the municipality has been supporting the associations since 2010). It is expected that this kind of support will move progressively from old sectors to new ones. That means also that the actual associations should find strategies to become self-functioning in the future by promoting their products.
- How to ensure the renewal of the equipment (for example will the UDDTs that were destroyed in the floods of September 2009 be re-built?)
- How to make the associations more financially independent?
- How to ensure the renewal of antiquated equipment in eco-station due to the inability of the eco-stations to be managed themselves and limited means offered by the municipality?
- How to motivate the farmers to use constantly birg-koom (urine fertiliser)? They consider urine (liquid fertiliser) as more difficult as the application of mineral fertilisers (powder). Additionally, the storage of urine requires more space.
- There are many differences in the management capacities of what existed for the three town city districts.
- Non involvement of institutions taking part in the process of durability along all 36 months: Technical and financial difficulties of what existed and the spread of the system to be considered.

- The full support of the project brought the issue of sustainability.
- Project view: reluctance of households to pay for latrine maintenance and excreta collection.

On the other hand, success factors of the project were:

- Successful accounting for the socio-cultural realities during the technologies conception: inventory and inspection of rented property,
- Production of a strategic witness plan,
- Acceptance of the approach by the town city districts, households, SME and market gardeners thanks to tremendous sensitisation and subsidy,
- Communicational and promotional activities,
- Development of the capacities of stakeholders,
- Creation of a Geographical Information System with a link to that of ONEA (National Office/Agency for water and sanitation) showing the location of the UDDTs,
- Appropriation of the approach by the Government: Working plan of the National strategy for sanitation,
- Ownership of the project by people of concerned sectors: They have well understood the importance of the project for their health. This translates into strong demand for UDDTs even though the project has been stopped,
- With the introduction of UDDTs, behavioural changes compared to poor management practices of excreta are clearly visible. Unlike the misuse of latrines in beginnings of the project, there is noticed a proper use of latrine by households who rejoice of the benefits,
- Strong opportunity of technical durability and beginning of the financial one,
- Production of important documents on the strategic implementation of ecosan.

Overall, the results have been encouraging at both household and farming level. The municipal authorities have embraced the concept. At ministerial level, the Minister for Agriculture has spoken out in favour of the approach, and the double benefit it is bringing in sanitation and agriculture, noting its compatibility with the national operational strategy for food security, which aims to reduce the number of people suffering from malnutrition in Burkina Faso by 50%.

The transfer of responsibility of the project to the local authorities is ongoing. ONEA is planning to integrate the UDDT in their portfolio of latrines in the four concerned sectors. The "ECOSAN-action team" of Ouagadougou municipality created to follow up on the collection chain, and support for the associations has been established since the beginning of 2010.

Since the end of the EU project (from January 2010 onwards), the municipality supports the associations until they become self-functioning. This will be effective when ONEA will continue the building in the four sectors in future years to increase the number of toilets built but also to sell more products to the farmers and collect more fee from household level. The associations sometimes receive a helping hand from CREPA in finding customers and for transportation. The government has also implemented an advertising spot on the national television to raise awareness among people for the use of ecosan products.

The use of UDDTs is seen as having the potential to make an important contribution to reaching several of the Millennium Development Goals at national level, including those outlined in the National Programme for Water Supply and Sanitation and the Strategic Framework for Poverty Reduction.

The main donor of the project, the EU, has also expressed its satisfaction and is now financing a second large-scale ecosan project using a similar approach which is aimed at farming families in the rural province of Kouritenga via a fund earmarked for improving food security through improved soil fertility (through the Food Facility ACP-EU).

How did the UDDTs resist the floods in Ouagadougou in Sept 2009?

On 1st September 2009 there was unusual and wide spread flooding in Ouagadougou. UDDTs had an advantage over pit latrines during flood events because they were being more durable and could still *contain* the excreta (depending on the severity of the flood).

According to Chiaka Coulibaly, the experience here was that none of the UDDTs built with concrete blocks collapsed after the flooding. For those UDDTs whose vaults were built with local material (mud, clay or adobe blocks) they collapsed when the water has reached the level of the vault. In total, 20 out of 932 UDDTs collapsed. In some areas only ecosan toilets remained after flooding.

In addition, from the 20 UDDTs which collapsed, most of them were located in depressions areas, where all household had been forced to leave the place.

12 Sustainability assessment and long-term impacts

A basic assessment (Table 1) was carried out to indicate in which of the five sustainability criteria for sanitation (according to the SuSanA Vision Document 1) this project has its strengths and which aspects were not emphasised (weaknesses).

Table 2: Qualitative indication of sustainability of system. A cross in the respective column shows assessment of the relative sustainability of project (+ means: strong point of project; o means: average strength for this aspect and – means: no emphasis on this aspect for this project).

	collection and transport			treatment			transport and reuse		
Sustainability criteria	+	o	-	+	o	-	+	O	-
• health and hygiene	X			X		X	X		X
• environmental and natural resources	X			X			X		
• technology and operation		X		X		X		X	
• finance and economics		X	X		X	X		X	
• socio-cultural and institutional	X			X			X		

Sustainability criteria for sanitation:
Health and hygiene include the risk of exposure to pathogens and hazardous substances and improvement of livelihood achieved by the application of a certain sanitation system.
Environment and natural resources involve the resources needed in the project as well as the degree of recycling and reuse practiced and the effects of these.
Technology and operation relate to the functionality and ease of constructing, operating and monitoring the entire system as well as its robustness and adaptability to existing systems.
Financial and economic issues include the capacity of households and communities to cover the costs for sanitation as well as the benefit, e.g. from fertiliser and the external impact on the economy.
Socio-cultural and institutional aspects refer to the socio-cultural acceptance and appropriateness of the system, perceptions, gender issues and compliance with legal and institutional frameworks.

For details on these criteria, please see the SuSanA Vision document "Towards more sustainable solutions" (www.susana.org).

With regards to long-term impacts of the project, the main impacts of the project are:

1. After the floods, around 912 households (or about 5930 people) still have UDDTs, thus increasing the number of families with access to improved sanitation facilities, and preventing pollution from poor excreta management.
2. The UDDTs should improve public health (such as reduced rate of diarrhoea incidences in children). It is planned to assess this during the final evaluation of the project in 2010 (was this done? Results?) (baseline was carried out in the beginning of the project).
3. Many urban farmers in Ouagadougou now recognise sanitised urine and dried faeces to be efficient fertilisers. The local ecosan champions among the urban farmers will be crucial for the uptake among others. The ecosan fertilisers have a market potential, but their competitiveness is also a function of chemical fertiliser prices. If artificial fertiliser prices increase in the future, the demand for ecosan fertilisers would also increase.
4. The project has helped to put sanitation in general and ecosan in particular higher on the political agenda. In the Implementing Plan of the National Sanitation Policy, UDDTs are now recognised as appropriate among other sanitation technical options. It is also planned to integrate UDDTs in the development of the next “Plans Stratégiques d’Assainissement” (Sanitation Strategic Plans) for small and medium cities in Burkina Faso.
5. The project’s infrastructure serves now as a research and teaching facility.

13 Available documents and references

- Bracken, P, von Muench, E., Panesar, A. R. (2009) Tackling the urban waste and food crises simultaneously and sustainably – examples from the Philippines and Burkina Faso, 34th WEDC conference, Addis Ababa, Ethiopia. http://www2.gtz.de/Dokumente/oe44/ecosan/en-tackling-the-urban-waste-and-food-crises-simultaneously-and-sustainably-2009.pdf
- WSP (2009) Study for Financial and Economic Analysis of Ecological Sanitation in Sub-Saharan Africa, Water and Sanitation Program – Africa, The World Bank, USA. http://www.wsp.org/UserFiles/file/Ecosan_Report.pdf
- Fall, A. (2009) Report of main achievements and success/failure factors of the project (in French) - Document de capitalisation des acquis et leçons apprises du projet Ecosan_UE1. Consultancy report for GTZ. http://www2.gtz.de/Dokumente/oe44/ecosan/fr-des-activites-du-projet-EcoSan-EU-2009.pdf
- Campaoré, O. A., Dioma, S. K., Fall, A. (2009) Mid-term assessment of ecological sanitation in peri-urban areas of Ouagadougou (in French) - Evaluation à mi-parcours du projet d’assainissement écologique dans les quartiers périphériques de la ville de Ouagadougou, consultancy report for GTZ. http://www2.gtz.de/Dokumente/oe44/ecosan/fr-evaluation-du-projet-assainissement-ecologique-2009.pdf
- Coulibaly, C. (2009) Management of ecosan system in urban areas: "ecosan_ue project case study" in four sectors of Ouagadougou, Burkina Faso, paper at the Sanitation and Hygiene symposium in Accra, Ghana, 3-5 Nov 2009. http://www.irc.nl/page/50790
- Makaya, J. (2009) Control of the physico-chemical and microbiological agricultural fertiliser based on sanitzed urine: assessment of health impacts (Contrôle des paramètres physico-chimiques et microbiologiques du fertilisant agricole à base des urines hygiénisées : évaluation d’impacts sanitaires), Consultancy report for CREPA (Makaya’s MSc thesis). http://www2.gtz.de/Dokumente/oe44/ecosan/fr-évaluation-d'impacts-sanitraires-in-ouagadougou-2009.pdf.
- Kameni, A. (2010) Comparative study of strategies for implementation of ecosan concept in various contexts (Etude comparé des stratégies de mise en œuvre du concept ecosan dans divers contextes), MSc thesis, Ouagadougou, Burkina Faso. http://www.susana.org/lang-en/library?view=ccbktypeitem&type=2&id=965
- Unknown. Project for the improvement of the agricultural fertility by usage of hygenised human excreta as fertiliser in 30 villages in Kourittenga (Projet d’amélioration de la productivité agricole par l’utilisation des excréta humains hygiénisés comme fertilisants dans 30 villages du Kourittenga.), Burkina Faso. http://www.susana.org/images/documents/nl32/gtz-ecosan-nl-32-ecosan-ue2.pdf

Additional photos (2008 and 2009):

- http://www.flickr.com/photos/gtzecosan/sets/72157613296193005/
- http://www.flickr.com/photos/gtzecosan/sets/72157625719409533/
- http://www.flickr.com/photos/gtzecosan/sets/72157623223068890/
- http://www.flickr.com/photos/gtzecosan/sets/72157625643299691/
- http://www.flickr.com/photos/gtzecosan/sets/72157625642803125/
- http://www.flickr.com/photos/gtzecosan/sets/72157625696108825/

Video clips

- On YouTube[11] about UDDTs in prison: http://www.youtube.com/watch?v=1F-MgqrDs8g
- On YouTube[12] about reuse demonstrations: http://www.youtube.com/watch?v=Bc8NKaPrni4

14 Institutions, organisations and contact persons

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Case study of SuSanA projects

Urban urine diversion dehydration toilets and reuse, Ouagadougou, Burkina Faso

SuSanA 2011

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This document is available from:
www.susana.org

[11] Three UDDTs are installed at the prison (MACO) of the city of Ouagadougou, Burkina Faso. The prisoners are in charge of the management of the whole system: O&M of the toilets, treatment of the urine and faeces collected, and agricultural reuse of the EcoSan by-products in their own fields in the prison.

[12] Results from field experiments in Koupéla (Burkina Faso) on the use of ecosan by-products as fertiliser (urine and/or dried faeces) for the production of maize.

[13] DGAEUE is the most important institution (political instrument) in charge of sanitation in the country, whereas ONEA is the national implementation agency for urban sanitation. DGAEUE falls directly under the Ministry of Agriculture, Water and Fisheries Resources.